4. INFILTRATION BMPS

VEGETATED SWALES

Vegetated swales are broad, shallow earthen channels, lined with dense vegetation. They promote infiltration through the soil and trap pollutants by filtration through the vegetation. The combination of low velocities and vegetative cover promotes the settling of particulates and some degree of treatment by infiltration.

Planning Considerations

Applicability: Vegetated swales are most appropriate when the impervious area which drains into them is small. Swales can be used along roadways in place of curbs and gutters.

Flow Volume/Velocity: Vegetated swales are most effective when the flow depth is shallow and the velocities are low. Also, the soils should be suitable to establish a vigorous stand of vegetation. If dense vegetation cannot be maintained in the swale, its effectiveness as a BMP will be severely reduced.

Slopes: Areas with steep slopes may limit the use of swales. In such areas, swales should follow the contour of the land.

Flow Duration: To be effective in removing stormwater pollutants, swales must not be subjected to low flows of long duration, and must not be kept wet for long periods. This will saturate the soil and may kill the vegetation, reducing the amount of pollutants removed.

Wildlife Habitat: In order to increase the potential for wildlife habitat in and around a swale, it is recommended that an additional, minimum 10-12 foot wide, no-mow buffer strip be incorporated into its design. This buffer strip should be located between the swale and developed areas, and could be planted with a variety of food-producing grasses, small shrubs and/or native wildflowers.

Design Criteria

Long-term performance research suggests the following design criteria will optimize the success of a swale:

Soils: Underlying soils should have a high infiltration rate (at least 1.0 inch/hour). The soils should be tilled before the grass cover crop is established to restore any infiltration capacity lost during the construction process.

Channel design: The channel should be designed for low velocity flow. Higher velocities might be permissible for channel stability, but could result in re-suspension of settled particulates. Flow depths in the swales should be minimized to increase the amount of vegetative filtering and settling. A maximum design flow depth of 1 foot is suggested. The grade of the channel should be as flat as possible, preferably less than 2 percent.

Infiltration and sedimentation enhancement: The hydrologic performance of vegetated swales can be improved if check dams are used to temporarily pond runoff (see Check Dams, page 3-7).
Vegetation: Vegetation for swale linings should be selected based on soils and hydrologic conditions at the site, in accordance with the guidelines for vegetative cover, page 3-3.

Maintenance

Routine maintenance is important to keep a swale in good working condition. Mowing should be done frequently to maintain a growth of vigorous, dense vegetation. Grass should not be trimmed extremely short, as this will reduce the filtering effect of the swale. The cut vegetation should be removed to prevent the decaying organic litter from adding pollutants to the discharge from the swale.

Routine maintenance should include the immediate repair of newly formed channels or gullies; re-seeding bare spots; removing trash, leaves and/or accumulated sediments; and the control of woody or other undesirable vegetation. Routine fertilization and/or use of pesticides is strongly discouraged. Be sure to eliminate the gradual buildup of soil and grass adjacent to pavement which would prevent the entry of runoff into the swale. The mowed height of the grass should be 2-4 inches taller than the maximum flow depth, but a minimum of 6 inches.

Vehicles should not be allowed in the swale. The area should be inspected for failures following heavy rainfall and repaired as necessary. If complete re-seeding is necessary, half the original recommended amount of fertilizer should be applied with a full amount of seed.

Swales with Check Dams

A vegetated swale with check dams is used to retard and temporarily confine runoff in order to induce infiltration, and to provide an opportunity for nutrients and other pollutants to be filtered and settle out. The check dams create small infiltration pools along the length of the swale. A swale with check dams is more effective than a grassed swale because of the greater infiltration and settling they cause.

Check Dam Design

The check dam should be constructed of durable rock or rock-lined material to avoid erosion. The area just downstream of the check dam should be protected from scour with properly designed rock riprap or protective channel lining. The check dam may have a solid level surface integrated into it for added durability as shown in Figure 6.4. The heights of check dams are generally 6 to 12 inches, depending on the channel slope and the desired storage capacity. The check dams should be notched to allow the flows which exceed the dams' infiltrative capacity to escape. Check dams should be designed so that the water ponded behind them will infiltrate in 12 hours or less.

Maintenance

The level of deposited sediment in the channel should be monitored regularly, and sediment should be removed from grassed channels before permanent damage is done to the grassed vegetation, especially if infiltration times are longer than 12 hours. Sediment should be removed from riprap channels when it reduces the capacity of the channel.